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NATIONAL HEALTH & WEALTH

PROMOTED BY THE

GENERAL ADOPTION OF THE DRY EARTH SYSTEM;

INCLUDING

THE SAFE, INOFFENSIVE, AND PROFITABLE DISPOSAL OF LIQUID REFUSE.

BY

THE REV. HENRY MOULE,

VICAR OF FORDINGTON, DORSET.

PART I.

LONDON: W. MACINTOSH, 24, PATERNOSTER ROW.
DORCHESTER: H. LING, COUNTY HOUSE.
1875.

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PRICE TWO SHILLINGS.

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CHARLES DICKENS AND EVANS,
CRYSTAL PALACE PRESS.

NOTICE.

By the fatal results, during the past year, of the improper disposal of the sewage at the Wandsworth Asylum for Orphan Girls, and under the deep conviction that by the adoption of the Dry Earth System, as I then had improved and enlarged it, such evils are entirely preventible, I was constrained to announce, in a letter addressed to the Editor of the *Times*, that I would undertake the publication of everything I know with respect to the removal and disposal of House and Town Refuse. This I am now prepared to do.

Only let it be distinctly understood that in this publication no approach will be made to any disclosure of the mode discovered by me of the introduction of Silicic Acid into manure. For under strict obligation to secrecy this has been purchased of me by W. S. Allardyce, Esq., C.E., Salisbury House, Fordington, Dorset, the sole manufacturer of the Phospho-Silicon Manure. The value of this discovery, if only it could be made known to every farmer and gardener in the land, would be almost incalculable, as tending both immediately to the increase of the wealth of the nation, and ultimately to vast improvements both in Agriculture and Horticulture. On this ground I venture to hope that, by the liberality of the Public, I may some day be enabled to publish it. But to the working

of the Dry Earth System, developed in this work, it is not essential, although it forms a very important addition to that System, especially in large towns. It must, however, pass for the present.

Meanwhile by that, which I am fully at liberty to publish, the Wealth as well as the Health, and the Domestic Comfort, and the Morality of the people of this country may be almost indefinitely increased.

I would therefore earnestly ask all those, into whose hands this little work may fall, to read it with most careful attention. And, if they shall be convinced by it of the practicability and efficiency of the plans proposed, then I would still more earnestly ask them to assist me liberally in its circulation throughout the country. I have not the means of doing this myself. If the benefit to be derived from this System is to be, as I believe it will be, *national*, this little work must be widely circulated, and that speedily. Parliamentary discussion of sanitary measures is about to commence, and (to speak now only of the rural districts) I venture to say that no other so feasible relief for the evils existing in those districts can be proposed as that which is set forth in the pages of this work.

H. M.

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PREFACE,

BEING

A Paper written at the request of the Council of the Society of Arts for the Conference held at the Rooms of the Society, December 10th, 1874, on the Pollution of Rivers.

At the request of the Council of the Society of Arts, I venture to present to this assembly proposals both for the entire relief of our rivers and streams from pollution, and for the utilisation, in the true sense of that word, not only of the valuable substances, which in causing that pollution are worse than wasted, but of all the refuse of our towns and villages, and of detached houses. Our rural districts no less than our large towns demand the most serious attention of the Legislature.

These evils of pollution and waste are the necessary result of the daily accumulation of putrefying and putrefied matter, first in the drains and sewers, or cesspools, or privy vaults, and then in the case of the former at their outfall. To deal with such intractable substances *en masse*, and especially with a view to their utilisation, is a sheer impossibility. Such a vast evil must be dealt with at its source or sources, and in detail. These sources must either be diverted into other and separate channels, or be altogether cut off. This by means of water is just as impracticable as the dealing successfully with the accumulated mass. Under that system,

however, which I would base on the general adoption of the Earth Closet, it is perfectly feasible. And by it not only shall that pollution and waste be relieved, of which we have such great reason to complain, but the dwellings and the external atmosphere of our towns, and villages, and detached houses shall be relieved from foul smells and deleterious gases.

For 1st—By the general adoption of the Earth Closet that substance is withheld from the drains and sewers which is the most offensive, the most uncontrollable, and, though in itself the most valuable perhaps as manure, the main cause of injury and of difficulty in any mode hitherto adopted for the disposal of sewage.

2nd.—The withholding of this—the solid excreta and much of the urine—from the drains and sewers, obviates the now necessary flushing of the closets, drains, and sewers; and thus by cutting off 5-6ths of the consequent requisite water supply, and by the use of the Earth Closet together, the accumulated mass at the outfall (or in future at more than one outfall) is reduced 70 per cent. or more—probably 80 per cent.

3rd.—The remaining 3-10ths or 1-5th, consisting mainly of the slops and sink-water of the houses (not forgetting, however, the water used in some factories), thus relieved from any large amount of solid matter, can be so easily dealt with, that sewers and large drains would no longer be required.

4th.—For in smaller drains, and at comparatively little cost, it might be conveyed to suitable reservoirs, and from thence, whether by pumping or by gravitation, and before putrefaction commences, be either applied to land in the immediate neighbourhood of the town, or removed in part for the manufacture of manure for more distant places.

Now, with reference to the question of utilisation, let us first take such a town as Over Darwen, with a population

of 25,000 souls. The Earth Closets (though the vault into which each would discharge its contents need not be emptied above once in three months) would yield a produce from which a Company might manufacture 60 tons of manure per diem. I will say nothing here of the value of the Phospho-Silicon manure; but only suppose that such a company could realise on this manufacture 10s. per ton, there would arise from this source alone £10,000 per annum.

But what of the liquid refuse? Let us take five gallons a head for the water supply. Three gallons would be sufficient for effecting the profits of which I am going to speak. But I take the larger estimate as the most difficult to deal with. This will give 125,000 gallons, or say 2,000 hogsheads to be disposed of daily. Now, this distributed at sufficient intervals of time over an adequate extent of land, and before putrefaction sets in, can create no offensiveness on the surface of the soil; neither can it through the subsoil pollute springs, or wells, or rivers. Supposing then 600 hogsheads of such manure per annum to be applied to an acre at three successive periods, either to the soil or to the growing plant, and supposing the crops grown to be rye grass, clover, roots, or cabbages, &c., for feeding cattle, how many head of cattle, fed in stalls, would that acre carry? Let it be borne in mind that by alternate planting there may be two or three or four crops per annum, and if the whole produce be given to them, three and even four cows might be fed on a single acre.

Now the liquid refuse of 25,000 people would yield 600 hogsheads per acre per annum to 1,000 acres. And from these 1,000 acres, with a due amount of capital and skill and labour, I feel confident that £30 per acre or £30,000 per annum might be realised. Supposing, moreover, 1,000 cows to be fed thus, and a portion of the vegetable produce sold

for the use of man, what an excellent supply would thus be afforded of wholesome vegetables and of pure milk! I should imagine that a Company with a capital of £100,000 or £200,000 might do all this; and, while completely relieving the river from pollution, and the soil and atmosphere from poison, it would very largely promote, by means on which I cannot dwell, habits of cleanliness, decency, and morality. Such is the plan I would propose for towns.

As to the country, I find by careful experiment that the liquid refuse of a family, as many as ten in number, if applied daily in due succession to the plant and to the soil, may be safely and inoffensively disposed of on 16 perches of ground. And a cottager with a garden may, from those 16 perches, from the produce of an Earth Closet, and from a pen of 20 fowls occupying a perch of ground, raise that which shall be equal to £20 a year. This fowl pen has a second object—viz., that of being a substitute for the dungheap and the pigstye. The soil within it should be left in its natural state; all waste matter should be thrown into it, and anything good for manure. And if it be turned over once a fortnight, the cottager, in addition to 2,000 eggs, might make in a year one or two tons of manure. These, together with the contents of the closets, he might sell to the manure manufacturer or to the farmer. The two together would be worth more than the barley he would require for his fowls.

Now, if so much can be done on 20 perches of ground, much more readily may it be done on larger premises; and, if so, then in all such cases, at least, the Legislature may most justly interfere and cause it to be done. With such an alternative there can be no difficulty in the way of the legal probihition of the privy vault, of the hole for sink-water at the door side, and of the casting refuse into the neighbouring

ditch. But beside this the runnings from the farm-yard must be equally excluded from the ditch and the village stream; and the privy vault and the cesspool of the wealthier classes must be prohibited too. These last not unfrequently discharge their contents, or at least their offensive overflow, into the ditch, the outfall of which is into the brook, from which, at no great distance, perhaps, the people draw their water. Let a law be passed and enforced that no house of any description with 20 perches of land attached to it shall have either cesspool, privy vault, or drain, and half the sanitary difficulties of the rural districts would cease.

In the case of cottages and houses in villages or small towns, which have no garden, let the proprietors be compelled, either to find land for the purpose or some means of removing the refuse of the family safely and at their own cost, *and not at the cost and to the injury of others.*

CHAPTER I.

INTRODUCTORY HISTORY.

I CONSIDER it due to myself as a Clergyman, who during fifty years has had the spiritual charge first of a parish of 3,000 and then of a parish of 2,200 souls, that I should give some reason for my having devoted so much attention, and apparently so much time to matters, by some persons considered inconsistent with my sacred office. From the very commencement of this long period, while the first and supreme object of my life has been the saving of souls, the very next has been the moral, social, and physical improvement of the working-classes; amongst whom my lot has chiefly been cast.

To this latter object, therefore, a large portion of my hours of recreation from spiritual and educational work has, with some sacrifice of the society of my friends, been devoted. Rather, perhaps, I have frequently made it my recreation either in my own neighbourhood or in the Metropolis or other large towns, or again in the most remote village, to observe carefully the condition of the working-classes. At the same time I have endeavoured to keep my eyes open to anything, however trivial in itself, which might under some possible contingency be brought to bear on that condition. And God has given me a memory capable of retaining such observations, until two or more of them have been made in combination to

produce the most important results. It was thus that the deodorizing property of Dry Earth, and its power of *assimilation*, and still further its marvellous capability of *repeated action* were made to appear to me; whence has followed in almost natural sequence the now completed Dry Earth System. Thus also by a combination of three observations, made, the first thirty years, and the second fourteen years previous to the last, that the mode became known to me of *introducing Silicic Acid into the Earth Closet manure*, by which the stalk of Wheat, Barley, Oats, and Grass is strengthened, and by which, when properly mixed and applied, the Potato Disease is, as I firmly believe, prevented.*

Some years previous to the introduction into Dorchester of the Sewerage System the physical and moral evils arising, in great part at least, from the want of proper and decent accommodation for the working classes in a portion of my parish, appeared so great, that to provide some remedy I raised a subscription in the neighbourhood, and added to that subscription £50, the proceeds of lectures delivered by me in Bath and some other towns, on the Antiquities of Nineveh and Egypt. And while engaged in the application of the funds thus raised, my investigations into the extent and the true nature of the difficulty of dealing with excremental matter were greatly quickened by the outcry as to the state of the Thames, and by the repeated declarations in the Reports of Royal Commissions, that the pollution of rivers, occasioned by the Sewerage or Water System, had become a great National evil demanding immediate correction.

From the Thames my mind was soon directed to the

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* See "Potato Disease and its Remedy." Three Letters addressed to the Editor of the "Times." Sixpence. W. Macintosh.

brooks, and rivulets, and ditches of the rural districts; and I saw the same evils, only in different proportions, existing in every direction, but apparently unnoticed by Rivers Pollution Commissioners and by the Boards of Health. In many a detached house and many a small village the evils of the old privy vault in poisoning wells and ditches and in corrupting the air, had been increased by the Water Closet of the wealthier classes: the overflow of the cesspool of which is frequently conducted into the neighbouring ditch, and from thence to the rivulet. The want of forethought, and (if I may venture to say so) the want of common prudence on the part of Civil Engineers, of Architects, and Builders, and of Sanitary Reformers in these matters is truly marvellous. Equally marvellous is the readiness, with which individuals and whole communities can from some fancied necessity become habituated to evils and abominations which, when looked at from a distance, appear intolerable; and yet more astonishing is it that both individuals and communities can in their efforts for their own convenience and comfort coolly inflict these evils and abominations upon others. The wealthier classes by the overflow of the cesspool of the Water Closet pollute the brook or rivulet, from which those lower down the stream draw their water. Until recently (if even yet the evil be remedied) the Bilston Brook has received the sewage of the population of the town of Bilston. Yet Bilston Brook was (if it be not still) one of the feeders of a reservoir of water for the people of Birmingham.

From facts like these the conviction was forced on me with ever increasing power, that notwithstanding some partial and local benefits, and these mainly due to the attendant benefit of a pure water supply, the Sewerage System was in many cases doing little beyond a shifting of the evils which it

professed to relieve; that some of the evils it rather aggravated; and that the cost of the requisite works was imposing on the public an increasing burden of taxation.

That, however, by which my efforts have been chiefly stimulated, has been the perception of the close connection between moral and physical evil, both through the absence of all proper arrangements, and through the often inadequate arrangements of the Sewerage System. In the blocks of houses, in which the selfishness of the manufacturer, or of the landowner, or of the speculator in building, compels his fellow creatures to dwell, those arrangements must almost always be imperfect, and deficient, and of an evil tendency. In the courts and yards of the metropolis and of all large towns, and even of some smaller towns, this is inevitable. In the courts and yards of London there may be found, probably, in the basement of the house one convenience for six or perhaps eight families. In a large manufacturing town I found one place with a trickling supply of water for three seats: and this appeared to have been set up by the Board of Health, or, at all events, under its sanction, for the common use of the men, women, and children of thirty tenements; the rental of each of which was 2s. a week. In such a condition of things what reasonable expectation can there be of habits of cleanliness, or of decency, or of morality?

It was just at the time when my mind was thus more fully alive to these several forms of evil, and to the difficulties and *impossibilities* of the water sewerage system, that I suddenly became acquainted with the properties of dry sifted earth or clay. The discovery of those properties was so clear and distinct, yet so unsought; the circumstances which led to that discovery were, as regards myself, so entirely accidental, yet in such marked combination and dependence on each other,

that I could not but regard them as ordered in the providence of God, and as intended for my direction.

A brief detail of some of these circumstances may be useful. A friend had informed me that he had purchased a house on the higher ground of Dorchester. This house had been built only sixteen years, during the whole of which period another friend had inhabited it. I enquired if due attention had been paid to the water supply, telling my friend that the water of the well on the premises, which had been very good for the first two years, had for the following fourteen years been unfit for use. He investigated the matter, and in a week or two invited me to see the result of his investigation. It was this: The house stands on the chalk subsoil. The extent of the site of the house and of the small garden is not many square feet. At one corner of this space, within the house, was a Water Closet with its cesspool, the depth of which was 14 feet. At the opposite corner, in the garden or court-yard, was a well 60 feet deep. My friend had excavated several feet between these two points below the bottom of the cesspool; and the course of the sewage through the chalk, at an angle which would strike the bottom of the well, was distinctly visible. The source of the evil was cut off, and the well cleared out; and the water became pure.

As I looked on the excavation, I learned a lesson as to my own premises. It occurred to me that, although I had no Water Closet, the privy vault of a large family was nearer to my well than the cesspool was to the well on my friend's premises. I resolved at once to put an end to the risk of poisoning the water, from which seventeen persons were drinking. The next day the vault was filled up with earth and chalk, and arrangements made for carrying everything in buckets into the kitchen garden, where it was buried. A

trench was dug, two feet deep; and the boy, who did the work, was instructed, when he filled in the earth to stir if beneath for a few minutes with the spade. Why I gave him this direction I cannot say. After five weeks I had the curiosity to turn up the portion of the trench first used, and was not a little surprised to find there nothing but earth. The boy, who was an intelligent fellow, on seeing my surprise, said, "Why, sir, I tried that a fortnight ago, and 'twas all gone, then! What's come of it?" "I am sure I don't know" was my reply, "but it's worth thinking about."

Just at this time the spring was opening, and my garden being overlooked from a neighbouring house, I considered such an operation, if performed by daylight, might be an annoyance to my neighbour. So with this first glimpse at the absorbing and deodorising property of earth I threw up a rough shed in a corner of my garden, collected there three or four loads of sifted earth; and in this shed the boy mixed the earth with the contents of the bucket until nothing offensive could be either seen or smelt. The operation used to occupy about ten minutes each day. In about five weeks the whole quantity was in this way used, and had been thrown during that time from one corner of the shed to the opposite corner. This operation was repeated; and while using the same quantity of earth in this way for the fifth time I so established in my own mind the principles of a system, and I became so fully convinced that in this discovery God had opened the door to immense relief and benefit of a world-wide character, that I published my first pamphlet on the use of Dry Earth, under the title which I prefix to my present work—"National Health and Wealth." This I published in the confident but vain hope that Sanitary Reformers would take up the idea and work it out. The only notices of the pamphlet, of which I

was made aware, were one by a leading chymist of the day, and the other by a country clergyman. The former at first pronounced my statement respecting the property of *repeated action* in dry earth to be "all humbug," but, after careful enquiry, was convinced of its correctness and truth. The latter earnestly requested me, for the benefit of his parishioners, to publish my views in a more popular and a cheaper form. This led to the publication of a tract entitled, "Manure for the Million," of which some 10,000 copies were sold.

In the pamphlet I observed that in working out the proposed system great advantage might be derived from the use of machinery; but, unconscious of any mechanical skill in myself, I looked to others to do the work. And it was simply because no one else seemed inclined to do it, and because I was convinced of its being the will of God that it should be done, that my mind was practically directed to the subject; and, aided by the merest accident, I carried out the idea of an Earth Closet. On the sudden recollection of a simple mechanical contrivance for feeding horses I persuaded a friend, who was a builder, to make my first attempt. Numbers, who saw this, highly approved of it; but no one would undertake to manufacture and sell without the protection of a Patent. Of neither Patent Rights, nor Laws, nor of business of this kind, did I know anything; neither, again, could I give time to anything of the sort. I was compelled, therefore, to get help from others; and thus by force of circumstances, and with the noble aid of one or two generous and public-spirited friends, I have been led on to mechanism, to Patents, to a business firm, and to the formation of a Company.

At each of these successive steps any pecuniary interest I might be supposed to have in the work gradually decreased; until now that interest consists in 100 shares of the Earth

Closet Company, value £10 each. This I mention without the least disposition to murmur. Rather I would take this opportunity of stating my belief that, but for that little Company and for the spirit and energy with which its Directors and Managers and Engineers under vast difficulties have worked, this, which I venture to think will yet prove a world-wide benefit, would have been lost.

This invention of the Earth Closet, however, with all the varieties of its form and mechanism, which have been added by the engineers of the Company, forms only a portion of that, which should rightly be styled the Dry Earth System or the Dry System. The relief indeed which the Earth Closet affords to the sewer evils and to the pollution of rivers is great; but it leaves untouched the difficulty of the removal and disposal of *sink water and slops*. The Earth Closet Company has from the first recommended in its prospectus the use of *sub-irrigation;* and in suitable soils and localities this affords most effectual relief of the difficulty. For more than ten years I availed myself of it. But from the first I have seen that, if this Dry System is ever to be universally or even generally adopted, some mode or modes of disposing of the liquid refuse of a house must be discovered, which would be available for every house (whatever the soil and sub-soil on which it stands) from the Cottage to the Palace, and for the most secluded hamlet as well as for the populous city. That discovery has at length been fully made; and my object in the following pages will be first to set forth the principles on which the Dry Earth System rests, and then to give full and detailed descriptions of the various modes of the application of the system to the removal and disposal of all house refuse, both solid and liquid.

CHAPTER II.

THE PRINCIPLES OF THE DRY EARTH SYSTEM.

THE main foundation of the System is beyond question in the property possessed by ordinary earth or clay of various kinds to absorb liquid and vapour; and so to deodorize anything of this kind which may smell offensively; and so also to disintegrate substances partly liquid and partly solid, and thus to *assimilate* the manurial particles as food for plants. This property varies in the three former particulars, if not in the latter, according to the dryness of the earth employed, and according to the proportion between the quantity used and the condition and quantity of the matter to be deodorized. If either solid or liquid excrement or the sink water of the kitchen be allowed first to putrefy, a far larger quantity of dry earth will be required for its deodorization than would be sufficient if applied immediately to prevent putrefaction. Again, if into a vessel, filled with nothing but sink water from the kitchen and bed-room slops, no more earth be placed than would make it a very thick mud, it will putrefy and emit a most offensive smell within forty-eight hours. And for this reason it is that no continued irrigation of fields with the ordinary sewage of towns can fail in time to be very offensive and more or less injurious to the neighbourhood of those fields.

On the other hand, if immediately on the use of the closet a

small portion of dry earth be applied, the deodorization is complete and putrefaction is prevented. And if, on the complete intermixture of the substances, whether from absorption, pressure, or machinery, the whole mass be thoroughly dried (and this may be done without the slightest offensive smell), it may be used again for the same purpose. So great is this capability of *repeated action* that the same earth has thus been used twenty times, and with the same efficacy the twentieth time as the first.

In the same manner a small portion of dry earth or clay—say 3 lbs. or 4 lbs. for 30 gallons of liquid—if placed in the vessel which receives the sink water from the back kitchen or the slops from the bed-room, will prevent putrefaction for thirty-six or nearly forty-eight hours, while 56 lbs. would not prevent putrefaction beyond that limit of time. In this state the liquid sewage of a town, then, undiluted by the volume of water, required under the Sewerage System for *flushing*, and freed from all solid excrement, may be applied to a sufficient extent of soil, not only without the slightest offensiveness or risk of injury to health, but, as I have stated in my preface, with great profit.

From these several properties of earth or clay, then, we are able to derive the following principles of action, under which the difficulty of the removal of house and town refuse, insuperable under the Water Closet System, can be completely surmounted, and with vast increase to the wealth of the country.

I.—We can take the difficulty at *its source;* we can deal with it *at once;* and we can deal with it *in detail*. This under the Water Closet System is impossible. There is, indeed, under that System a certain amount of relief at the source. This, however, is effected only by shifting the evil to others,

aggravated at every step of its course, and dealing out disease and death as it passes along, until in the pollution of some river, or of some land at the outlet of the sewers, it becomes from its daily accumulation an impossible difficulty. In all this, moreover, there is sad and sinful waste; in contrast to which stands the following great principle of action in the Dry Earth System.

II.—In God's Providence there is no waste. Substances, which in themselves seem perfectly useless, and even injurious, when rightly used and treated, become most valuable. Thus, some fifty years ago, for cleansing the market-place of a certain country town, a scavenger received £100 a year. At the present time considerably more than that sum is paid for the privilege of getting possession of so much valuable manure. So now the *utilization* of house and town refuse, which, under the Sewerage System, is, and ever must be, an empty name, becomes under the Earth System perfectly feasible, and that to the extent stated by me in the preface to this work. Instead of the population of our towns being burdened for the promotion of their health with a large increase of taxation, they may, with the entire abolition of those sources of disease and death, the water closet, the sink, the drain, and the sewer, and by the adoption of the Earth System be entirely freed from Local Taxation.*

III.—The last principle of action, or, rather the last characteristic of this system, which I will give is this: that in it provision is made for the rural districts as well as for towns and cities; and equal comfort and advantage (if not greater) offered by it to the poor as to the rich. The

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* "Town Refuse the Remedy for Local Taxation." By the Author. One Shilling. W. Macintosh, Publisher.

rute of mortality is frequently as great in a small village as in the most crowded towns. The cause is on all hands admitted; but what relief can be afforded by the Sewerage System? None whatever. Nothing is ever proposed but an improved water supply. The Dry Earth System, as I propose in the next chapter to show, can afford complete relief.

From the inspection of a highly-finished water closet in the palaces at the West End of the metropolis, let any one go and inspect the soil-pans in the courts and yards of St. Giles's; and let him observe how little the Water Sewerage System, which has cost the whole population many millions sterling, is doing for the working classes in comparison with the rich. It cannot indeed do more than it does. But the Dry Earth System, modified and enlarged by the additional agency of fire, in a manner similar to that described in Appendix I., may *in time afford decent accommodation to every tenement in the most wretched yard.* In my development of the System, however, I must begin with the cottage in the country.

CHAPTER III.

THE APPLICATION OF THE SYSTEM TO A COTTAGE WITH A SMALL GARDEN.

Considering the very little which has been done by the advocates and supporters of the Water Sewerage System for the rural districts of this land, it should be no slight recommendation of the Dry Earth System, that in its full development the most simple and complete application of that system will be to villages and hamlets, to detached houses, and even to the most humble cottage.

On this account, and for the fuller elucidation of the principles and modes of action in the gradually ascending scale of difficulty from the cottage to the mansion, or from the hamlet to the metropolis, I shall first describe the process of the profitable disposal of the refuse of a cottage and premises to the extent of twenty perches, or one-eighth of an acre. And if it can be shown that on so small a plot of ground as this the entire refuse of a family of ten persons can be disposed of without any offensive smell, with great sanitary advantage, and with large profit to the family, we shall find in this humble instance a great starting-point in the all-important work of sanitary reform.

It is this. The occupier of such premises being able to

cleanse them both with benefit to himself and without detriment to others, should be required by the Legislature to do this. There must no longer exist on those premises a cesspool or vault to pollute the water of the neighbouring wells, nor the hole at the door side to poison the air around. Offensive matters must no longer be thrown into the neighbouring brook, nor into the almost stagnant ditch. Let the means of preventing certain diseases be placed within the cottager's reach, and it may then be shown to him that his duty to God and to his neighbour demands of him the use of those means. If risk to the health and life of himself and his family, and the risk of imposing upon others the cost of the restoration of health, and, it may be, the maintenance of his family, can be avoided, then surely it is the duty of every Christian not to incur that risk. And if so, then is it equally the duty of the man, of whom the cottager may rent such premises—a duty the fulfilment of which the Legislature should enforce—to provide the means of avoiding that risk.

I shall first treat of the disposal and then of the removal of the liquid refuse of the cottage; because if the value of that refuse as manure (increased as it is by my proposed mode of application) be once perceived, there will be little difficulty felt as to the small amount of labour involved, either in the use of the Earth Closet, or in the daily removal of this liquid refuse from the house to the garden. I take, then, a cottager's family, numbering ten persons. This number is preferred to the average of five or six persons to the family; because, while the produce arising from the manure will of course be greater in proportion to the size of the family, the labour of removal in a smaller family will, in the same proportion, be less. And, as in the proposed case of ten persons I shall take no account of the manure from the closets (which in such case

might be sold to the farmer), this might, in the case of a smaller family, be applied to the garden.

From the extent of 20 perches I deduct four perches for the site of the cottage, out-house, and fowl pen, and for garden paths; and I consider the cultivable land to be no more than 16 perches, or 483 square yards. Reckoning then the liquid refuse at three gallons a head, or 30 gallons daily, each of these square yards would receive during 365 days as nearly as possible 22 gallons of manure, such as a cottager can rarely procure for his garden. This, however, must be so distributed over the ground that the soil shall retain the manurial properties of the refuse, and none shall penetrate the subsoil, so as to run to waste or to incur the risk of poisoning any well or spring.

The process of distribution may be thus illustrated. I consider the 16 perches to be laid out for the first time, or entirely remodelled. I suppose this to be done in the autumn, say early in October. Let strips, the width of the spade, and, from centre to centre three feet apart, be dug throughout the whole of the ground; and as this digging proceeds let cabbage plants be put in, 12 or 18 inches apart in the line; and let the 30 gallons of the liquid manure be each day applied to 120 feet of it. This would dispose of the refuse for 12 days, during which 960 cabbages would be planted.

On the completion of this work of planting and manuring, the cottager will commence the careful digging or forking of the intermediate spaces; and on every 12 yards of these he will pour the daily supply of 30 gallons of refuse. The whole space of 320 yards would thus receive a good supply of manure within a month; and this watering (with or without forking) might be repeated twice during the winter; and so the liquid refuse would be disposed of for four months out of the twelve.

At the latter part of February the cropping of the intermediate spaces should be commenced with parsnips, broad beans, &c. (this might be done, if wished, in November); and, as this proceeds, during March the rows of cabbages should receive three waterings, in the same order and in the same proportion as that observed in October.

These details will, to many persons, be tedious, but they are important in helping to establish these two great points: first, the safe and inoffensive disposal, which may thus be made, of liquid sewage under the Earth System; and, secondly, some approximate estimate of the value to the cottager of such a disposal of it on so small a piece of ground. As to the former, safety is secured in this distribution of such liquid, partly by the evaporation, occasioned not only by the sun but by high winds, partly by the absorbing and assimilating properties of most soils, and partly by the fact that a shovel full of dry earth, and even (as I believe) a shovel full of fine coal ashes in 30 gallons of sink water, will prevent the putrefaction of such water for nearly 48 hours, or, at all events, for 36 hours.

As to the value of the manure, I will assume, as a kind of standard, the supposed cropping in the month of March or April of the intermediate spaces with a second set of 960 cabbages; and, on the removal of the first set, I suppose an equal number of cauliflowers to supply their place; and further, that between these and the second set of cabbages, 100 dozen lettuces be grown; in all which cases the watering will be as in the first instance. (This has been done, in proportion to the space, on one perch of ground.) The value of the cabbages, if used by the cottager's family, or sold by him retail, would be a penny each; if sold to a dealer in vegetables, a halfpenny each. I take the latter value; and the worth of

the two crops would be £4. The cauliflowers ought to be worth as much; and the lettuces ought to be equal to one crop of cabbages. So that on this general but low estimate there might be raised out of 16 perches of ground as much as £10 by this regular application of liquid sewage. Since, however, in any of these intermediate spaces two lines of beans, or three drills of onions, or of parsnips, or carrots, would greatly exceed in value one row of cabbages, and in either case be succeeded by a crop of savoys, the full value of the entire produce might fairly be set at £15.

I have myself on this plan grown on 90 square feet (one-third of a perch) 63 lbs. of potatoes, for which a dealer in vegetables offered me 4s. 6d.; and from a single row of scarlet runners, 18 feet long, I have had a produce even larger than this. Indeed, from the extent supposed, viz. 20 perches, and from a vine against a wall, and 100 currant bushes, I raised, for several years, produce to the value of £20, and even £25.

And here I may fairly be allowed to turn from the sanitary view of the subject, and glance, for one moment, at the vast improvement in the condition of the working classes in hamlets, villages, and small towns, to which this mode of disposing of house refuse opens the way. While in its adoption habits of order, and sobriety, and cleanliness, would be promoted, the labourer or the mechanic might add from 4s. to 6s. a week to his means of support. At the same time the labour required in this mode of cultivation, including that of the removal of all the house refuse to the soil, would not exceed that required in the ordinary good cultivation of a garden.

To prove this last point I must next describe the mode of removal of the liquid refuse from the dwelling to the garden. As for the supply and removal of the earth for the closet, this need not involve the labour of more than five or ten minutes

a day. I know this to be the fact where three closets are in use. On several accounts, especially for the separation of the sexes in a large family, and again, for relief of one of the greatest cottage trials, during seasons of sickness, there ought to be two closets to each cottage, one upstairs and one downstairs. These should have a common vault or chamber, made water tight, and the communication with this from the upper closet should be by means of a 12 in. earthenware pipe. In both cases, with a garden close at hand, a box of earth and a scoop would with a little care supply the place of machinery; and thus the necessity of very finely sifting the earth and of highly drying it would in such cases be obviated. The pipe in this way forms in fact for a time the chief receptacle, and ordinarily nothing need be removed from below oftener than once a fortnight. Nor, if the vault or chamber be of good size, need anything be taken from it oftener than once in three months. So that this portion of the sanitary and economical work of the cottage would require even less time than that required in the case of three closets above mentioned, in which, because of its several great advantages, machinery is used.

But to return to the subject of liquid refuse; the back kitchen of the cottage (and every cottage ought to have a good back kitchen) should be furnished with a sink trough, standing a very little higher than the bottom of the housewife's washing tub or washing pan, and close to this tub or pan. This trough should empty itself by means of a pipe through the wall. And outside this wall, just beneath this pipe, there should be a galvanized iron bucket capable of containing 15 or 18 gallons. There should be two such buckets movable on shifting wheels. On either of these being filled, so that a strong boy or a strong woman could wheel it, this should be removed to the garden,

and the liquid refuse, received into it, be applied in the manner above described. In ordinary cases with two buckets in use, the removal to the garden might be deferred until the evening or the early morning of the next day.

But to return to the sink trough; into this the water used in cooking and in cleansing the house would be so easily poured, *that all temptation to throw it on to the ground before the door or into a hole at the door side would be removed.*

The greatest evil to be obviated, however, is that of throwing *the bed-room water* either into the hole at the door side or on a heap of ashes, perhaps, and decaying vegetables. This, however, may easily be obviated by means of a pipe through the wall of the room above the back kitchen. This pipe should have a head to it in the room with a cover to it. The head might be the pan of an ordinary water closet, incased in wood. The pipe from this pan would terminate just outside the wall; and through it the liquid would descend through another pipe with an ordinary iron head into the iron bucket before mentioned. The object of thus cutting the pipe into two parts is to obviate all chance of foul smell or injurious gas rising through it into the house. By this simple contrivance the labour would be saved of carrying a bucket downstairs, and the above-mentioned temptation be removed of throwing its contents, when so brought down, on some spot near the door.

Into the iron bucket all the dust of the rooms should be thrown, and the finely sifted ashes; because these would serve, together with a small quantity of tolerably dry earth, to prevent for a time the decomposition of animal matter in the liquid refuse. But the sanitary reform of the cottage—or, as I would prefer to say, this scheme for the improvement of the health and wealth of the cottager and his family, will not be complete without some mode of preventing the heap of

decaying vegetables, which is continually to be found near the cottage. And this is as feasible as the other arrangements. Let one of the perches which I deducted from the 20 perches of ground, be wired, or in some other manner be fenced in for the feeding and roosting of 20 or 25 fowls. If Cochin or Brahma fowls be chosen, the fence need not be high nor expensive. Let the soil be left in its natural state, and let no more gravel, or sand, or lime, or chalk be thrown into this space, than the fowls will require for digesting their food, and for the formation of the egg-shell. Into this pen let all the cabbage leaves and the stalks (split for the sake of the food inside them) and all other vegetable refuse, and indeed a good deal of animal refuse, be thrown. Only let the ground *be dug over at least once a fortnight.* From the vegetable and animal matter, and from the worms during great part of the year, the fowls will get so much food as to require but little barley. And from eggs and chicken, and from one or two tons of very good manure, which may thus be manufactured, there may be raised for the cottager another £5, £7, or even £10 a year. Twenty Cochin hens will eat as much of the refuse leaves of the garden, as a pig would; and if the roosting place be kept clean and whitewashed, no nuisance whatever is occasioned by the proximity of fowls to the cottage. There is nothing at least in any way approaching to the nuisance and evil of a pigstye in any part of premises so small as those proposed.

Other varieties of produce might be mentioned; such, for instance, as the fruit of some 30 or 40 well kept currant bushes; and other modes of consuming the refuse vegetable matter, such as that of keeping rabbits on one out of the twenty perches of ground. Only in that case let the floor be asphalted one or two feet below the surface of the soil. Or goats might be kept for their milk. But, surely, enough has

been stated to prove that by such arrangements, as those given above, the health, the comfort, and the circumstances, and general condition of the cottager would be vastly improved. And there is no exaggeration in the assertion, grounded on this, that if such arrangements should become general there would soon through the cottager class alone be a large increase in the wealth of the nation.

This case of the cottage, however, must not be dismissed without some detailed description of the application to it of the Dry Earth Closet, and of the mode of working this part also of the Dry Earth System. The importance of the subject must excuse its unpleasantness. Its full importance will be felt by those alone, who know by experience the discomfort, the misery, and, not unfrequently, the danger, which will arise from want of anything like proper accommodation in the sick room of a cottage. With a view to such accommodation, and for the sake of decency and even morality, there ought to be in every cottage in the country at least some such provision as the following:—

In the floor of a small projection from the upper storey, there should be inserted a 12 in. earthenware pipe, glazed within, rising 18 in. above the floor and terminating at 9 or 12 in. above the bottom of a vault two or three feet.* The part above the floor would be furnished with a seat and a pan and cover, and this, with or without machinery, might be used as a closet. If not, its use would be this. There should be in every cottage an earthenware commode with an earthen pail for times of sickness, and through this pipe its contents could be immediately and inoffensively discharged.

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* It is essential, especially in wet soils, that the bottom and sides of this vault should by means of clay and cement be made watertight.

Around the bottom of the pipe earth should be heaped so high as to exclude all draught upwards. With this provision it becomes a main receptacle of the contents of the closet and commode, and ordinarily need have nothing removed from it for two or three weeks, according to the number using it. After that time the cottager will have only to remove with his shovel one or two barrow loads to the side of the vault, and the upper portion will fall and fill up the space below. If three weeks be allowed to pass between each removal, the substance removed will be scarcely distinguishable from common earth.

Over the same vault there should be on the outside of the cottage an Earth Closet for the males of the family; and the whole, together with a receptacle for dry earth, might be included in a small projection like a porch. If this should be near the chimney of the cottage, and kept pretty free from external moisture, the same earth (through its capability of repeated action) may be used again and again; and thus the quantity required for a whole year be comparatively small. The trouble of supplying it to the closet, especially if it be done from the outside, is very little. Compared with the value of the manure thus produced it is really of no account.

The provision of the earth is most simple. In dry weather let the cottager rake off about half an inch or an inch of the surface of his garden and spread it in a thin layer over the paths. In two days he will be able to sift it, and it will be fit for use. And if after use it be returned to the garden, its increased value is not easily estimated.

By many a working man I have been thanked for my earlier publication of this discovery. The objection, which is often raised against it, is either that cottagers will be unwilling to do the work, or that they will require to be

educated to it. Most assuredly, if they be left entirely to themselves to do it, and no provision of appliances be made by the owner of the cottage, almost any family would be not only unwilling but unequal to the work. But, in addition to the gentle compulsion of the fine on the privy vault and on the hole for sink water, the prospect of adding from 4s. to 6s. a week to his income would make all but the incorrigible drunkard or the incorrigibly idle both willing and earnest in such a work of improvement. And surely in the present state of things such a prospect should be sufficient to render both the landowner and the farmer ready and willing to take the first necessary steps in such a scheme, by providing the cottage and the little garden with the few needful appliances. And as to education for the purpose, the Inspector of Nuisances might prepare himself, not only to check evil, but to promote this great good. And the members of our Labourers' Friend Societies might extend their good work, which for some years seems to have been almost stationary, and teach the labourer, and encourage him in seeking, not merely to obtain a prize of a few shillings, but to add from 4s. to 6s. a week or even more to the means of support of his wife and family.

Oh! what a drawing of the different classes together in neighbourly and brotherly love would there be if all of the wealthier classes, who fear God, would in this and similar ways seek the true temporal welfare of their neighbours!

CHAPTER IV.

THE APPLICATION OF THE SYSTEM TO A VILLAGE.

PREVIOUS to the direct and particular discussion of this part of my subject it will be well, that my readers should form some definite idea of the necessities in sanitary matters of villages with populations varying from 1,000 to 1,500 souls, and of the impossibility of relief of those necessities under the water sewerage system.

I will take first a class of villages with populations varying from 100 to 600. Of these I am acquainted with several, that may be regarded as typical of hundreds or even thousands of others. In some of the smallest of these villages, situated in marshes, and fens, and moors, or close to, if not in, the water meadows of Wilts and Dorset, epidemics prevail quite as frequently as in our crowded towns; and in some of them at least the average rate of mortality for 10 years may be found to have been as high as 34 per thousand. In many of them, while some of the dwellings are situated on ground, that is high and dry, yet, as to others, the water is within 6 or even 4 ft. of the surface of the soil, on which the cottage stands. Into that water the cottage well is sunk; and from it the family drink. Yet within a few yards of the cottage the privy vault is sunk, perhaps, into the same bed of water,

or at all events so near to it that the poisoning of the water is almost inevitable.

In other villages with populations varying from 200 to 600 I have known such a state of things to exist as the following. A large proportion of the population is scattered, either in detached cottages or in small hamlets, over several square miles of country; but a considerable number of cottages is clustered round the church, the parsonage, and the mansion. Through or below this part of the village a little stream flows; and from it the people draw their water. Yet if we ascend that stream a very little way, we shall find either that privies are erected over it, and all the refuse of the cottages on its bank thrown into it, or that into it, perhaps, through some ditch by the road-side the runnings from the farm-yard, and the overflow of the cesspools of the water closets of the parsonage, the farm house, and the manor house find their way.

In a village in a Midland county, which on one occasion suffered sadly from diphtheria, I found a little stream, which, at its spring appeared purity itself, fouled by the runnings from two farm-yards, and by the refuse of more than a dozen houses, before it entered the principal part of the village.

In another county there is a village containing about 600 souls. The only supply of water is from wells not more than 4 or 5 ft. deep. It can have no other but at an extravagant cost. Every cottage has its privy vault; and most of them have the hole near the door, into which the slops, &c., are thrown. The soil is dry and the situation healthy; yet epidemics are by no means rare. Elsewhere I see a little stream which affords water, in one case to a small, in another to a large population, poisoned by the drains of the house of a large landed proprietor. In one of these cases the conscience of the proprietor was once smitten; and he anxiously sought

counsel of men of science. Such, however, is the inclination of the ground, that, so long as the water closet is used there, no remedy can be devised. One more case will be sufficient for my purpose. It is that of a population of nearly 1,500 souls, forming a village nearly a mile in length, with houses on both sides the street. With the exception of two wells sunk into a rock the water supply is derived either from surface wells, or from the sluggish little stream, which flows at the foot of the slope along which the village runs. There are sewers through the street, two or three of which empty themselves into the stream. Most of the cottages have the privy vault, which must affect the surface wells. In dry seasons a large proportion of the villagers drink from the poisoned stream.

Now in all these cases no one can deny, that some relief or remedy is urgently demanded. Sanitary reform is just as much needed in them, and in all low and marshy districts, as in the crowded towns. The evils are equally great in the one case as in the other. Only in the former they are to most persons out of sight, and, therefore, little felt and cared for; in the latter, by their presence in the midst of thousands, they compel attention.

In the case of large and populous towns, moreover, the sewerage system has appeared for some years past to afford such facilities of relief in the removal of offensive matter from the house, that sanitary reformers and Boards of Health have thrown their whole energy into the work of cleansing towns by this method. They seem not in the least to have anticipated the impossibility of applying the same system to rural districts and to very many smaller towns. Neither do they appear to have foreseen the aggravation of evil which the water closet generally proves, wherever in those districts it is adopted in the houses of the wealthier classes.

Some of these impossibilities and evils I will now endeavour to point out. In an entire village with a population partly gathered in a street and partly scattered over several square miles, the sewerage system is impossible, first, because of the extent of the area occupied by the whole population; and, secondly, because, if only the village street or streets should be drained, the disproportion between the cost of the drains and sewers and water supply, and the value of so much cottage property would be enormous. This latter reason applies to all the other cases, even to that of the village with a street a mile in length. The proportion of small cottage properties is too large, to admit of the enormous cost of drains, sewers, and of connection with those sewers, and of the provision of 30 gallons of water per head per diem of the population for flushing the closets and sewers, and of the continued working of the system.

Then in most villages, as in many a small country town, there are no outlets for the wasteful and dangerous stream flowing through these channels; especially if this country shall at length firmly resolve, that neither rivers nor brooks shall any more be polluted. Still the old shift of privy vaults and sink holes must no longer be continued. They are evident sources of sickness and death. They ought, therefore, to be abolished. True. Yet no Government can insist on that abolition without affording at the same time the provision of feasible and good substitutes. No substitute, however, has been devised; and I confidently affirm, that no such substitute can be devised in our rural districts in any connection whatever with the water and sewerage system.

Now in direct and striking contrast with this stands the Dry Earth System in its application, as exemplified in the former chapter, to a cottage with a small garden. To any of

the various villages above described, with a few slight modifications in the mode of carrying it out, this system offers in the place of sickness and waste both health and wealth. And this is to be obtained with little or no expense, compared with such as is involved in the adoption of the sewerage system.

On the introduction of the Earth System into a village, of whatever size, the commencement should be made with the cottages which have gardens equal in extent to at least the eighth of an acre. And with respect to these some one, well instructed in the system, should in the first place be engaged to point out and to exemplify in some one or more gardens the mode of the daily removing and distributing the sink water and slops of the cottage. By such instructor, whether official or voluntary, it should ever be borne in mind, that the great principle of this part of the system—the object to be kept constantly in view—is to remove the liquid refuse of the cottage before it can putrefy, and to distribute it so widely, that there shall be no risk of its sinking to the subsoil or flowing off into any place in which it can stagnate; and yet so that its fertilising properties may be brought to bear in the greatest degree on the vegetables and fruit bushes or trees in the garden. There need be no limitation as to the nature of the crops grown with this liquid manure. Those of the quickest growth are probably the best, both for taking up the manure from the soil and for rendering quick returns of profit. Scarlet runners or any kind of cabbage or kale are perhaps the best for both purposes. But wheat and other kinds of grain (although not to be grown with ordinary town sewage) may with the slops and sink water and other liquid refuse, duly tempered with the silicic acid of the Phospho-Silicon Manure, be grown with the greatest advantage. By the wide and regular application of such manure to the soil

onions also, and both parsnips and carrots, are made to grow on most soils with rapidity and strength. And here it may be observed, that with a few simple instructions from the "New School of Cookery" the cottager's wife might be taught, how from the variety of vegetables in one of the smallest gardens, with parsnips as a foundation, and with the addition of some animal substance in the form of milk from the goat, or eggs or the flesh of fowls, a most palatable and nutritious food may be provided for a large family.

In order to this disposal of the liquid manure for the garden, due provision must of course be made for its daily removal; and in the case even of the smallest garden it will be better always to have a bucket or tub, either of wood or of galvanised iron, capable of containing 15 or 18 gallons, and moveable on shifting wheels. This should be placed (as before stated) so as to receive whatever shall be passed through the pipes from the bedroom and from the back kitchen. Or, previous to the introduction of those pipes, or, in the event of their being none, it should stand near the back door. Immediately on the provision of a bucket for the removal of the liquid refuse its regular distribution might commence; and thus this very important step towards sanitary reform in our rural districts requires not the delay of a single week.

No sooner, however, shall this step have been taken, and the vegetables be advanced in growth, than a perch of ground should be enclosed for fowls or for a goat, near to the cottage; on to the soil of which (ungravelled and unpaved) the refuse animal and vegetable substances are to be thrown, and once a fortnight to be digged in. Or, if there be anything which might quickly putrefy, it might at once within this space be covered with the spade. Thus the ash heap, or mixen, will be abolished. There should be a good shed for shelter for both fowls and goat.

During the progress of the work thus far, provision should be made for the use of the Earth Closet; and, if made in the following simple way, the closet will readily be adopted by the cottager, especially when he is made to see the pecuniary profit to himself, which is likely to result from its use.

As he digs the garden, let him do the work thoroughly; let him dig deep; let him break the earth as fine as the soil will allow; and let him rake off the larger lumps of earth on to the path. If the weather be dry let him beat such lumps with the spade, and throw them the next day, or the day after, into the shed in which the Earth Closet will stand. There, at any spare time, he can sift it and prepare it for use. Otherwise a barrow load or two may from time to time be dug out of the fowl pen, and spread out in the sunshine to dry for sifting In clay soils, or any that are thoroughly free from chalk or gravel, beating or rubbing the dry earth will be quite sufficient without sifting. But it should be borne in mind, that, while in cases in which machinery is not used, there is not the same necessity for fine sifting as in those in which it is used, yet both its efficacy in deodorisation and its value as manure after use in the closet, would appear to be in some near proportion to the fineness to which the earth is pulverized. Care must, however, be taken to prevent its being so fine and so dry as to cause dust to fly.

As to the efficacy of earth as manure, after it has been used twice or thrice in the closet, it is found that, when finely sifted, the quantity required for a given crop is much smaller than would be the case if the earth had been originally rough and coarse. Thus for five or six square yards of onions, or turnips, or carrots, 5 lbs. or 6 lbs. weight would be sufficient. Only let it be placed in the drill before the seed is sown. Four or five pounds weight would be sufficient for a row of

peas 18 ft. in length. And, if carefully drilled in with the seed, one ton, or even half a ton, of sifted earth-manure which had passed three times through a closet, would be more efficacious on an acre of wheat, than twenty cart-loads of ordinary stable dung.

These remarks as to the value and efficacy of closet manure are requisite as preliminary to the consideration to which we must next proceed; namely that of the application of the system to such gardens in the village as shall occupy a quarter of an acre, half an acre, or an acre of land, or to premises of any extent.

First let it be observed that the liquid refuse of an ordinary family, together with the dung from the fowl pen (if both be carefully used), will not be too much for 20 perches, and will yet be amply sufficient for a quarter of an acre. The same appliances will avail, and the same course of cultivation may be pursued in the latter case as in the former. If the premises should extend to half an acre or an acre, the Earth Closet manure should be brought into use; and even for the latter extent of an acre, or even, I believe, for two acres, the liquid refuse and the dung from the fowl pen and from the Earth Closets, if used aright, would be sufficient to produce abundant crops.

But, wherever the ground exceeds in extent a quarter of an acre, it will be well, both for the more ready removal of the liquid refuse and in order to secure the full advantage of its fertilising properties, that its use should be limited to that space. Any of the ground beyond that quarter of an acre, and so far as half an acre, should be manured from the Earth Closet; and on it might be grown on the alternate system a crop either of early or late potatoes and two crops of cabbages or some kind of winter greens. Or, again, the

second quarter of an acre might be laid down to grass, from which, and from the refuse leaves of the vegetables in the garden, two or three goats would find abundant pasture. If the ground attached to a dwelling-house should be an acre in extent, then, while half of it might be used for the raising of potatoes and other garden produce, the other half acre would well support a cow. Indeed, two and even three cows, if kept in a stall and groomed with a whalebone brush, and if from that stall all the manure, both liquid and solid, should be regularly carried on to the cultivated soil, might be well supported on a single acre. The crops, consisting mainly of roots and cabbages, might on three parts of the space be three in number in the course of the year.

For a garden and paddock like this, even to the extent of two acres, the appliances for the removal of the house refuse need be no other than those required for a cottage with only a quarter of an acre of garden. This I know by the experience of a single case. It is that of a parsonage house with a family of eight or nine individuals. For four years past the entire refuse of the house has thus, to the great comfort of the family, been removed; nor is there a drain of any kind or cesspool on the premises. Previous to that period the cesspool of the water closet, receiving also the sink water from the kitchen, and sunk in a clay soil, inevitably poisoned the well. The gardener in this family is loud in his praises of the manure he now obtains.

If now from a parsonage with one or two acres attached to it we advance to the farmer and the occupier of the great house in the village, with their many acres attached to each, the process of the removal and disposal of the refuse of the house and premises would be very similar, and quite as feasible. The only change requisite in the appliances is this: instead of

a wheelbarrow a cart must be used, and a water-cart in the place of a bucket or tub on wheels. In either case, just as in that of the cottage with its garden, the extent of which is the eighth of an acre, the removal of the liquid refuse daily must be maintained. Otherwise, at all events within 48 hours, putrefaction, the great source of foul smells and of disease, sets in. If the land to which it is applied be partly grass and partly arable, there is no season of the year during which it cannot be removed day by day. Half-a-hundred weight of dry earth, or of burnt clay, placed in a cart capable of containing five or six hogsheads, would stay putrefaction for 48 hours, and so obviate the necessity of the work of removal and of manuring on Sundays. And, of course, if any will take the trouble to place the dry earth in the water-cart, the removal might be generally only once in two days. But few will take *that* trouble. The daily removal, therefore, for six days out of the seven is to be preferred.

Now, as to the value of the manure in these several cases, the entire refuse of the dwelling-house, with the manure to be derived from the number of fowls kept, would be sufficient to produce on the alternate system abundant crops from two or even three acres. By the refuse of many a large house ten acres might be made to yield two or even three crops a year. And by a Boarding School of 100 children, 20 acres might be rendered most productive. There is an instance on record of the ordinary sewage of an establishment of 140 individuals having produced for several years from two acres of land, fruit and vegetables, worth, at the market price £200 per annum. The annual expenses were £60. And thus, then, the income of the establishment was increased to the extent of £140.

Now if this could be done there, why should not something of the kind be done in the houses of which I am speaking ?

In the case of the farmer, however, there is another source of disease to be cut off, and another source of wealth to be considered, and the same may be said of the case of many a clergyman and of most owners of mansions. In the former case there are the runnings of the farm-yard, often now escaping into the neighbouring ditch, and polluting it; in the latter, the runnings of the stable-yard either following a similar course or entering some cesspool. Let these runnings, in either case, be properly preserved and used, and every horse and every cow will, by this liquid refuse alone, or with a little addition to it, well manure an acre.

Well, if this be so, and if such waste as now prevails may be prevented, and if such frequent sources of sickness and death as we have in our cesspools, and if the poisoning of our rivers and the pollution of our ditches may thus be stopped, why should not the Legislature interfere here as in the case of the Cottager, and enact that it shall be done? Let a fine or a heavy tax be imposed upon every cesspool, as well as upon every privy vault, and upon any escape of offensive matter of this kind from the premises of any individual, be he who he may. One great principle to be kept ever in view in the investigation of this most important subject is this—"*Every man should cleanse his premises at his own cost rather for his own benefit, and not at the cost of others: much less should he do this to the injury of others.*"

The improvements recently made in the Earth Closets are such that they may in various ways be used inside the house and up-stairs, as well as on the outside and on the ground floor; and on a plan similar to that recommended for the cottage all the liquid refuse of the bedroom, and all the sink water of the back kitchen of the largest house, may with perfect

ease be removed into the bucket or the water cart outside. Of this plans will be given hereafter. As to the Closets, full information may be obtained from the Manager of the Earth Closet Company.*

Supposing now all the premises in a village, which are of extent sufficient for the disposal of all the house refuse in the way I have attempted to describe, to be so arranged, there will remain only such cottages to be dealt with as have either no garden or one too small for the purpose. In most villages there are some of these to be found; in larger villages there are generally not a few; and sometimes six, eight, or ten may form a row. How are we to deal with these? To this I would reply, that if the value of the solid and liquid refuse of a family be such, as above stated, to the cottager, it will be worth not much less to the owner of the cottage or to some farmer or gardener. There would then be no great hardship, certainly no injustice, in the Legislature requiring that in such cases the owner of the property should either procure 20 perches of land very near to each cottage, requiring for this and for the needful appliances additional rent, or that with such appliances furnished to the cottage as it at present stands, he should effect either by himself or by some one, who would contract to do this, the removal of the liquid refuse daily, and the solid refuse as often as requisite.

A farmer or gardener might well give for the entire refuse of an ordinary family from 30s. to 50s. a year. The statements published respecting the value of Earth manure derived from the closets of a population of 800 souls on the estate of Baron Rothschild would justify a higher figure than this for the entire refuse of a family. It should be here observed that

* 5A, Garrick Street, Covent Garden.

in such cases the use of machinery for *measuring* as well as applying the earth becomes a matter of great importance; otherwise there can be no adequate approach to a standard of efficacy and of value.

In the present state of things such provision, as I have thus attempted to describe, is essential. But now that the Legislature is about to deal with that most important subject, the Dwellings of the Labouring Classes, I would fain hope that the day is not far distant when it shall be illegal to erect, at all events in any village, a cottage for the working-man without there being attached to it at least the eighth of an acre.

APPENDIX I.

IN LONDON AND OTHER LARGE TOWNS ABOLISH YOUR ASH-PITS.

THIS is perfectly feasible; and, if so, then—First, a very large diminution in street traffic may be effected; Secondly, one of the greatest sources of domestic annoyance, if not of danger to health, in large towns, may be cut off; Thirdly, a mode would in this way be provided for the disposal of much of the sink water of the house; Fourthly, there would be no raising of dust either in making up the fires or in cinder sifting; and Fifthly, the coal ashes might be utilised in the Dry Closet.

I.—Let all the grates of the house be furnished with a water-tight iron drawer, or moveable box, equal in its area to the grating of the bottom, and as closely fitted to it as may be. This drawer or box should be from 3 in. to 6 in. deep, according to the size of the grate. Supposing either of these to be fitted to a grate or stove, the housemaid, when preparing to lay the fire, would be furnished with two or three quarts of water (the more soap or the more grease in it the better); and, having first stirred the cinders, so as to send into the drawer

or box such dust as may in that way be removed, she would then pour all the water on these cinders. These would absorb much of the water, and with it much of the nitrogenous matter it might contain, while by the rest of the water all the finer particles of dust, still remaining in the grate, would be washed into the drawer or box.

The cinders, saturated with the water, and left at the bottom of the grate, are improved as fuel, and form the very best foundation for a fire, which may be laid on them without any difficulty arising from their having been moistened with water. The downward radiation of heat from the lighted fire immediately raises a vapour from the cinders, which vapour, especially if charged with greasy matter, decomposes in the fire above; and on this the hydrogen burns. Thus the heat of the fire is increased, and the coal, which, if the cinders had been removed in the ordinary way, would have occupied their place, is saved.

Meantime, within a few minutes from the lighting of the fire, the evaporation of the water in the drawer commences, and the ashes in the course of the day are dried. The vapour also which arises from the drawer, and passes through the ignited carbon above, decomposes and burns. When dried, or better, when nearly dried, the ashes may at any convenient time be removed to a place where they would be stored either for removal or for use.

Before speaking more particularly of that use, it will be well to state, that wherever an objection exists to having a drawer to every grate (though if its many advantages be considered one wonders that there should be any objection),

a cinder-sifter of the following kind might be used: Let there be in the back kitchen a round iron bucket, having attached to it a sieve with a fine mesh, and 8 in. or 10 in. deep. Let the cinders to be sifted be placed in this sieve, and let nearly as much of the sink water of the back kitchen as the bucket will contain be poured over the cinders and through them into the bucket. If the bucket thus filled be placed immediately under the kitchen or back kitchen fire, or its contents be thrown into a well-bricked vault in front of such fire with a grating or opening immediately beneath it, the evaporation and drying will proceed with astonishing rapidity.

The action of fire from above, especially in producing evaporation, has not hitherto received from scientific men sufficient attention. The truth of this remark will appear more clearly, perhaps, from the use which I propose to make of the downward radiating heat, especially of the kitchen and back kitchen fire, in relieving the greatest difficulty of the ash-pit. One of the main uses of ash-pits at present, especially perhaps in hospitals, is the making it a receptacle of all offensive substances, whether animal, vegetable, or mineral, which cannot be passed through the sink into the drain and sewer. If, then, there shall be no ash-pit, or one of very reduced size, and if, still further, the ashes are to be used for some other purpose, what is to be done with all these substances? I reply: Place them in a well-filled drawer or box under either the kitchen or back kitchen fire. No offence or injury could arise from this; and great addition would be made by the gases, ascending into it, to the heat of the fire. In hospitals and in other large establishments, and in large private houses, there should be a fire provided partly for this special purpose,

and partly for warming rooms or heating drying chambers by the heat now wasted in the chimney.

The ashes which would result from this kind of *cremation* might be added to the coal ashes for the purpose which I now proceed to describe.

These ashes, if aided by the agency of fire, may be substituted for earth in the Earth Closet, especially in crowded tenements, or, as I propose to show in Appendix II., in sick rooms and in wards of Hospitals. Mixed with dry earth in the proportion of 1 to 3, they may safely be used in the closet or commode under any circumstances, but, unmixed with it, they cannot be used unless the agency of fire be added in the following manner :—

Let a drawer or box be fitted, as above described, to the fire-grate of the room, and let the ashes, in the way there also described, be dried ; and, when dried, let them be placed in the Earth Reservoir of the closet or commode. Ashes, when used in this way, will not, indeed, deodorise as dry earth does ; but if applied in sufficient quantity they are equal to the prevention of exhalation and smell, and *that*, if the mass remain undisturbed, for some time. If thrown carelessly in a heap on to an ash-pit, offensiveness would be as great as if the ashes had never been applied. But if taken immediately, or in the course of twenty-four hours, and placed in the drawer above described, immediately under the fire, evaporation, deodorization, and drying will at once commence and proceed rapidly. So much so, that under a tolerable fire, and with a drawer 4 in. in depth, each process would, in a few hours, be complete. The ashes, so dried, may be returned to the reservoir and used, not only with

equal, but with increasing efficacy, again and again. In Hospitals and sick rooms this would, under careful supervision, prove an immense advantage; and eventually it may afford effectual relief, which the sewerage system never can, to the crowded tenements in the courts and yards of the metropolis.

APPENDIX II.

ALL INFECTIOUS MATTER IN SICK ROOMS AND WARDS OF HOSPITALS MAY BE NOT ONLY DEODORIZED BUT DESTROYED.

LET each discharge, whether of excrement or vomit, be received in a vessel with a layer of dry earth or ashes covering the bottom. The moment after the discharge occurs let it be covered with other dry earth. Thus all exhalation will be prevented. In the former case the pail of the Earth Commode or an ordinary bed-pan would be the vessel employed; in the latter case it would be a basin held by the nurse, who in either case would have earth ready at hand for covering the deposit.

Let the fire-grate of the sick room or the fire-grates or stoves of the Hospital ward be furnished with an iron drawer closely fitted beneath. It should be three or four inches deep, or, if the fire be large, six inches. Into this drawer let the contents of the basin, or the pan, or the vessel be instantly removed and the drawer closed—evaporation effected by *the action of fire from above* commences immediately. The vapour, with minute particles of matter, passes into the fire, and if the

fire and the depth of the drawer be duly proportioned the whole mass will shortly be in a state of red heat. An ordinary fire will thus evaporate three and four gallons a day.

It might be well that the basin and the pail should be of uniform size and fitted to the size of the grate. Infectious and offensive matter of all kinds might be submitted to this action of fire from above; and in hospitals for any infectious diseases the linen of the patients should be washed on the premises and the soapsuds be made to flow into a space beneath a large fire provided for the purpose.

A way is thus opened for the almost certain stay of the progress of infection.

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